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ABSTRACT

The goals of the visual arts program of the Attleboro (MA) public schools, its relationship with the rest of the curriculum, and a study of the effectiveness of the program in seventh grade are described. It is suggested that the visual conceptual skills that are developed through the visual arts program are essential to cognitive processes and are prerequisite for language, mathematics, and scientific cognition and communication. A visual arts performance test was designed by the visual arts teachers to cover the concepts of sequence, basic structure, depth, balance, and visual analogy. This test was administered to seventh graders in Attleboro and in another similar community in September, 1977 and again in June, 1978. Sample items from the test are given, and the average scores for the pretest and the posttest for each community are tabulated for both total scores and scores for each of the five concepts. A table is presented showing the skills in reading, mathematics, and science that are assumed to be related to each of the five visual arts concepts. (CTM)

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THE EVALUATION OF VISUAL ARTS IN A BASIC EDUCATION PROGRAM

a paper presented at the annual meeting of
the American Educational Research Association

April 9, 1980

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ABSTRACT

The Evaluation of Visual Arts in a Basic Education Program
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Art teachers in Attleboro, Massachusetts have developed a Visual Arts Performance Test for seventh graders. Attleboro students and students from a comparable community, Community X, were given the test on a pre-, post-test basis. Analysis of the test results showed that the Attleboro students made a significant gain on total test performance and in each area of the test over the performance of the students in Community X. This test has shown that Art methods can be effective in improving the performance of seventh grade students in specific visual conceptual skills which are basic in reading, language, and mathematics education.

THE EVALUATION OF VISUAL ARTS IN A BASIC EDUCATION PROGRAM

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and
Edward Sullivan Ph.D.

Responding to a request of central administrators of the Attleboro, Massachusetts, public school system that all educational programs be regularly evaluated, the K - 12 Supervisor of Visual Arts and art teachers of that system decided to evaluate the effectiveness of their program for developing "visual conceptual skills" specified in their curriculum guides for middle school (grade six - eight) students.

"Visual conceptual skills" refer to perceptual competencies of responding, processing, and expressing the data of the senses. These functions were considered by Attleboro art teachers and administrators to be educationally basic, that is, universally useful and valuable cognitive functions.

Visual conceptual skills had been central educational objectives of the Attleboro program in visual arts since 1970, as a consequence of a federally funded, Title III, E.S.E.A. pilot program to establish a curriculum and methodology for teaching understanding of art as a nonverbal form of communication.

The visual conceptual skills orientation of the art program in Attleboro public schools was shaped with reference to publications of Rudolf Arnheim (1960), E.H. Gombrich (1960), Julian E. Hochberg (1964, 1962), Gyorgy Kepes (1956-1967, 1965), Jean Piaget (1954),

and perception psychologists Charles Solley and Gardner Murphy (1960).

The gestalt psychologist and art theorist, Rudolf Arnheim, had written of art (1960) that

> A work of art is a statement about the nature of reality. From an infinite number of possible configurations of forces, it picks and presents one...unified structure ...pattern of existence...presented in its valid form...Meaning is the function of the form...Perceptive vision is active exploration...the mind grasps essentials... seeing is grasping a few salient features. (pp 21 - 28)

Arnheim's conceptions of the nature of art and of the role of perceptual thinking in art experience and expression were instrumental in orienting Attleboro educators to the notion of art as a "nonverbal form of communication". Arnheim's view, which was further clarified in his 1971 publication, Visual Thinking, was reinforced in the publications of the artist and educator Gyorgy Kepes. In The New Landscape in Art and Science, (1956-1967) Kepes wrote of art that it

> attempts to discern order relations in nature, creating images of our experience of the world. Data are set out in terms of recreated sensed forms; and felt order is expressed in sensible structures exhibiting properties of harmony, rhythm and proportion ...Symmetry, balance and rhythmic sequence express essential characteristics of natural phenomena: the connectedness of nature-- the order, the logic, the living process. Here art and science can meet on common ground. (pp. 22-24).

In further clarification of the cognitive processes which are fundamental both in art processes and in the thinking processes of scientists, Kepes wrote that

> Abstraction is the basis of conceptual thinking. When we abstract from a situation we select certain factors as key; we discover in a simple and finite set of relations the essence of the infinitude of relations that contained them...The heightened perception of artistic vision collates sense impressions into a vision of the high patterning of works of art: harmony, balance, sequence and rhythm. (pp. 29-50).

Insights into the relationships which obtain between the fundamental visual thinking processes of artists and all conceptual thinking are provided by comparing the statements of Kepes and Arnheim with definitions of the nature of concepts made by cognitive psychologists Jerome S. Bruner et al (1956):

> A concept is a network of significate inferences by which one goes beyond a set of observed critical properties exhibited by an object or event to the class identity of the object or event in question...The working definition of a concept is the network of inferences that are or may be set into play by an act of categorization...categorizing serves to cut down the diversity of objects and events that must be dealt with uniquely by an organism...makes possible the sorting of functionally significant groupings in the world. (pp. 244, 246).

Arnheim wrote that what is needed is

> "a psychological and educational approach that recognizes art as visual form, and visual form as the principal medium of productive thinking...By furnishing images of kinds of qualities, kinds of objects, kinds of events,

> visual perception lays the groundwork of concept formation. The mind, reaching far beyond the stimuli received by the eyes directly and momentarily, operates with the vast range of imagery available through memory and organizes a total lifetime's experience into a system of visual concepts ...the various other purposes served by art can be shown to depend on this basic cognitive function...Once it is recognized that productive thinking in any area of cognition is perceptual thinking, the central function of art in general education will become evident. The most effective training of perceptual thinking can be offered in the art studio." (1971, pp. 294-315).

In writing of what he termed "The Role of the Arts" in "open education", Charles E. Silberman (1973) seemed to confirm Arnheim's concept of the fundamental function of art in educational, conceptual development:

> To understand the role of the arts in the curriculum, we need to understand how art relates to children's intellectual and emotional development...the process by which the child builds up successively more sophisticated internal models of the world--conceptual models by which he can organize, understand, and communicate experience...Representation--the creation of symbols--is thus the means by which the human being organizes his experience in order to understand or communicate it. Language is one way of representing or symbolizing the world; math is another, science another--and the imagery of art is still another. (pp. 749-750).

In recent writings, all of which tie art--or what are often termed "aesthetic"--ways of responding, thinking, and knowing to the needs and functions of basic education, Edmund B. Feldman,

Harry S. Broudy, and Martin Engel go beyond Charles Silberman's thesis that the arts parallel language, math , and science ways of conceptualizing and communicating, to strongly emphasize that artistic ways of experiencing and knowing precede--are prerequisite or foundational for--language, math, and scientific cognition and communication.

Edmund B. Feldman, art critic, historian, and educator, wrote (Dobbs, ed., 1979) as follows about the foundational nature of art in basic education:

> formal instruction in speaking, reading, and writing...cannot be initiated until a foundation has been established for dealing hypothetically, or symbolically, with basic concepts of space, time, order, likeness, quantity, size, and so on...Instruction in the so-called basics, which are essentially linguistic, cannot take place until a child has passed through Whitehead's 'stage of first apprehension,' or Bruner's iconic stage. In other words, there is a proto-language that children must learn before they can master the official school languages...art is a basic subject because it serves as a pre-lexial, pre-grammatical mode of learning. (pp. 86-91).

Harry S. Broudy, professor emeritus of philosophy of education and aesthetics of the University of Illinois, affirmed (Jan., 1979) Feldman's concept of the pre-lexial, pre-grammatical functions of artistic experiencing:

> "Concepts, logically and psychologically, come later than percepts, and percepts are images. We do not realize how much of thought and action is guided by images...It is this

> relation between the imagination and the other functions of mind that grounds the claims of arts education...Children with impoverished imagic stores will not read; they will simply decode mechanically messages that have been mechanically encoded...arts education...enriches the store of images that makes comprehension of concepts possible and comprehensive. This is the proper contribution of aesthetic education to language mastery, and if this is not basic to education, then it is difficult to imagine what would be." (pp. 347-50).

Martin Engel, Arts and Humanities Advisor, National Institute of Education, caps the argument that the arts--all the arts, including certainly the visual arts-- are fundamentals of basic education:

> The arts are a form of knowledge, a symbolic and expressive system or structure. Whether painting, sculpture, music, dance, theatre, literature, film, industrial design, architecture, or any other form of aesthetic endeavor, the activity takes place within the form of a symbolic structure--set which both is and contains knowledge. The arts can therefore be understood as cognitive processes...the arts are basic skills, no different from the reading comprehension skills that also call for the ability to aggregate, discriminate, conserve, structure, and restructure patterns, relationships, and configurations. (1978, pp. 26-27).

The K - 12 visual arts program of Attleboro public schools is founded upon these theoretical bases which link the perceptual, imaginational, and expressive functions of the art process to fundamental conceptual and communicative processes of human cognitive development.

The K - 12 visual arts program is an integral part of every student's total educational development. Through planned visual arts instructional experiences, each student is stimulated and guided to perceive, imagine, and represent in art media the imagery and patterns of relationship which can be visualized in various school subjects (English, science, math, social studies, the fine arts, etc.) as well as observed in the natural and constructed environment. These visual arts instructional activities represent conceptual visual skills of performances which have been organized to develop student competencies of responding, processing, and expressing the data of the senses in visual arts form.

To determine whether these perceptual competencies were being achieved, a Visual Arts Performance Test was designed by Attleboro visual arts instructional personnel. The test covered the concepts of sequence, basic structure, depth, balance and visual analogy.

These concepts were defined by the visual arts staff as follows:

Sequence - an arrangement of elements in succession. Sequences may show gradation, growth and transformation.

Basic Structures - the perception and representation of the basic patterns of organization of things observed -- or conceptualized -- in the natural and constructed world, and the ability to relate structure/form to function, intention or purpose.

Balance - the perception of equality or equilibrium among opposing or counterpoised forces within a visual field. Symmetry and asymmetry are systems of balance. The state of balance or equilibrium produces an effect of harmony.

Depth - the perception and representation of various levels of depth within a visual field of reference. Depth representation on a two-dimensional plane requires a knowledge of depth cues.

Analogy - the association of divergent things upon the basis of structural or formal similarities ("visual analogy" is distinguished from "functional analogy", though the perception of formal similarities among functionally differing things may suggest novel or unconventional functional applications, and may be a source of metaphoric language).

The test was administered on a pre- and post-test basis during the 1977-'78 school year to seventh graders in Attleboro and another community similar to Attleboro in its population makeup and in its per pupil school expenditures. This community, which served as a control, will be known as Community X in this paper.

The test consisted of 241 items of which 38 items were selected for scoring. The items selected for inclusion in the scoring of the test and the weight given to each concept were representative of the instructional attention given to each of the five concepts in the seventh grade Visual Arts curriculum in the Attleboro public schools.

The hypothesis which was established for the testing was that:

> Given at least two weekly periods, or an average of 90 minutes weekly of Visual Arts in basic education experiences during one school year, Attleboro students would significantly improve their visual knowledge and ability to process visual design problems in five conceptual areas, as compared with comparable students of another school system having a more traditional art educational program.

In September, 1977 the Visual Arts Performance Test was administered as a pre-test to approximately 300 seventh grade students from the three middle schools in Attleboro. Twenty-five students in Community X processed the pre-test. Through a process of random sampling 100 of the Attleboro students were selected for the post-test in June, 1978.

To match their pre-test experiences the Attleboro students selected for post-testing processed all of the items which had been on the pre-test when they were post-tested on June 6-8, 1978.

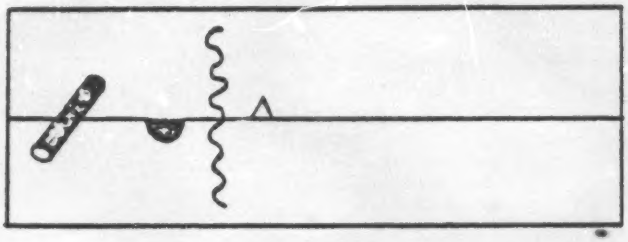
At the end of May, 1978 Community X students were post-tested only on the 38 items to be scored.

Sample items from the Visual Arts Performance Test for each of the five concepts follow:

Page A1 Sequence :

Complete the series found in the rectangle below. Draw right on the line. (A visual example was given).

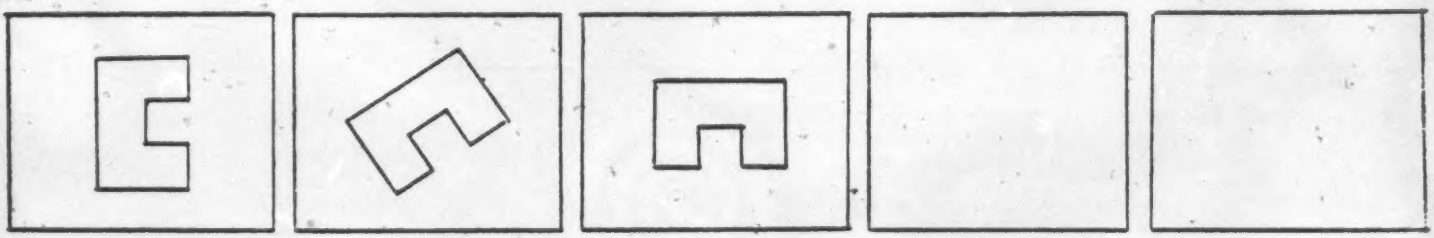
7.



Page A2 Sequence :

Draw in the empty boxes below so that each shape moves a little bit in order.

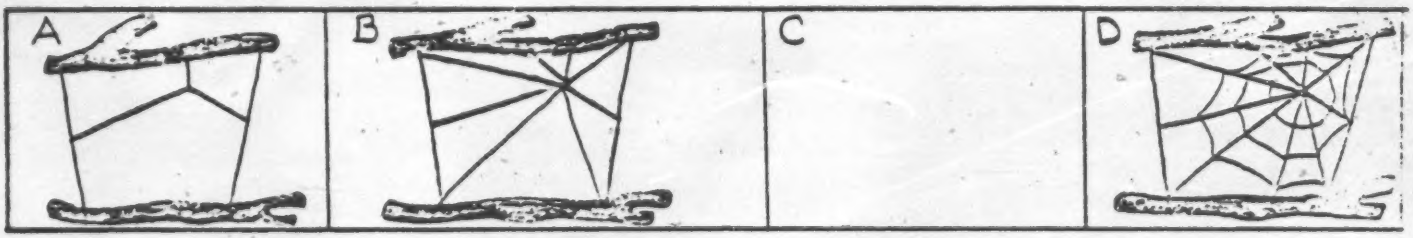
11.



Page B22 Sequence :

Draw in the missing step or steps in the empty box of the row.

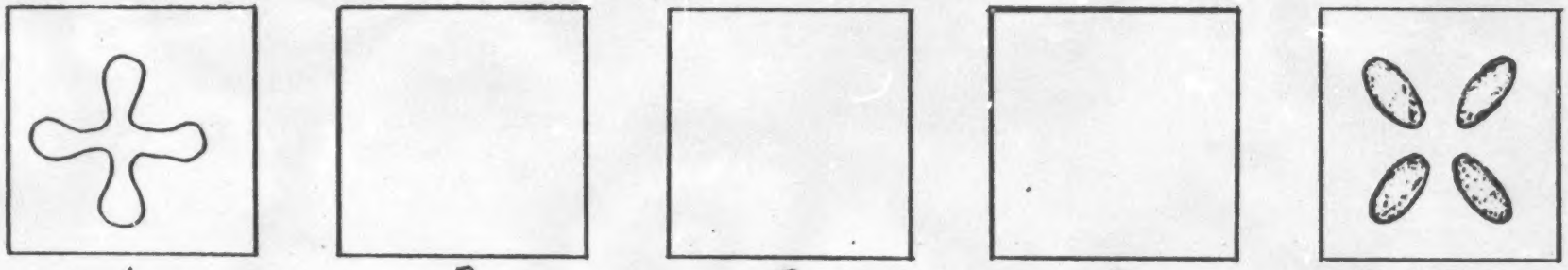
114.



P. C41 Item # 185, Sequence :

Working from left to right complete the 3 transformation sequences so that A changes slowly into E.

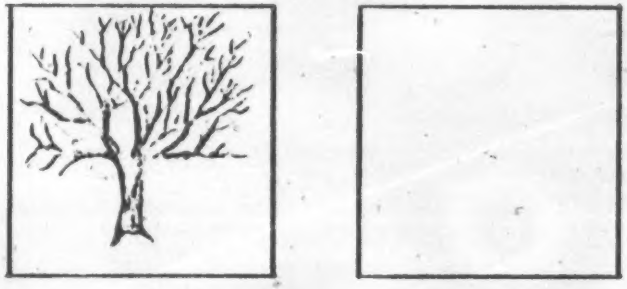
185.



Pg. A17 # 85, Basic Structures

Make a simple diagram of the basic structure in the drawing below.

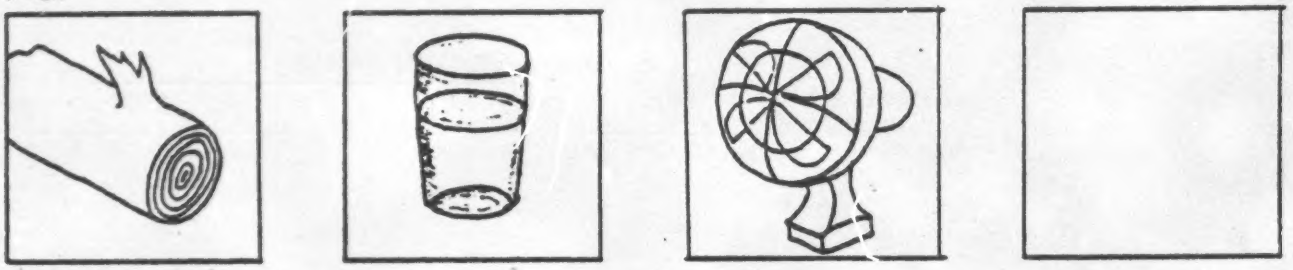
85.



Page A19, Basic Structures :

Decide what basic structure the first 3 pictures have in common, In the last box draw another object with the same basic structure.

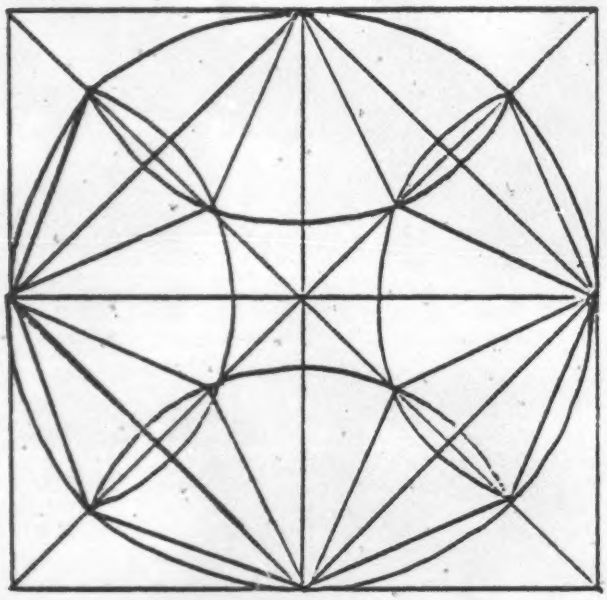
105.



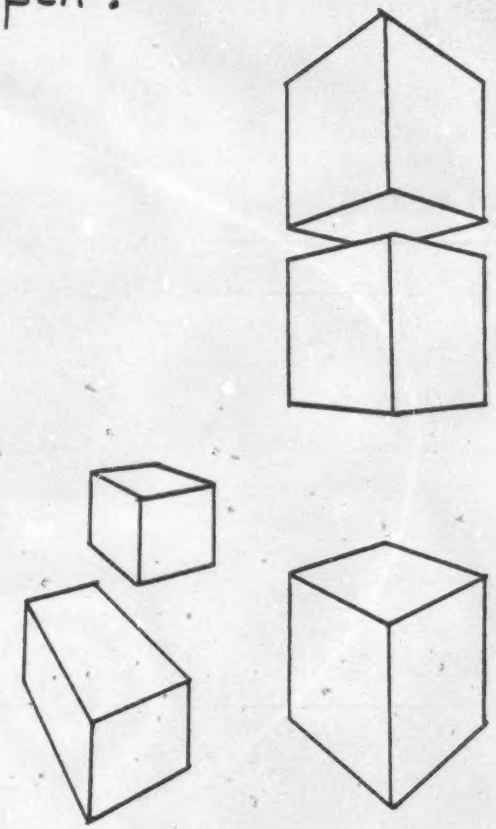
Page A9, Balance :

Draw in what you see is missing in the large square below to give the design perfect radial balance.

43.



Page C44, Depth :



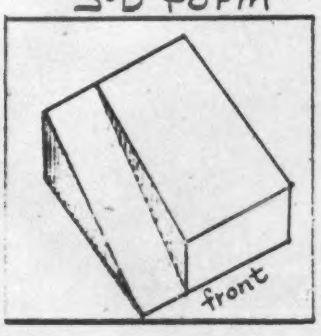
196.

These boxes were drawn with perspective lines. Find where the lines meet at a horizon and then draw the horizon line. Make a point (a dot) wherever the perspective lines meet at the horizon.

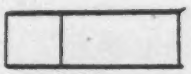
Page B31, Depth :

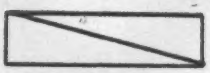
150.

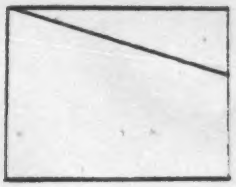
3-D form



Make a ✓ check on one of these three drawings which shows the front view of the 3-D form.



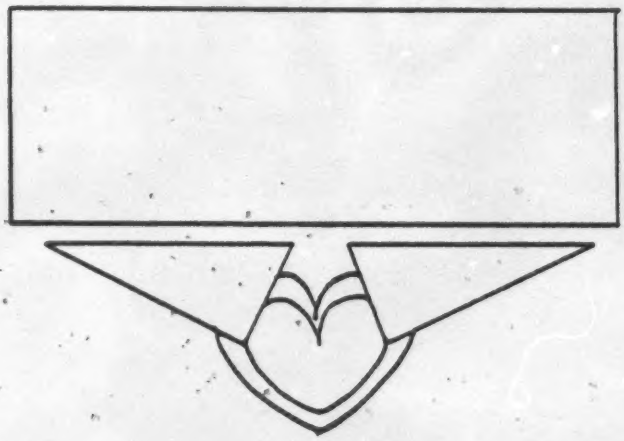




Page B34, Balance :

(Sample given showing a "mirror" image of objects below a box)
Draw what the mirror would look like if the objects or shapes were set on a table in front of it.

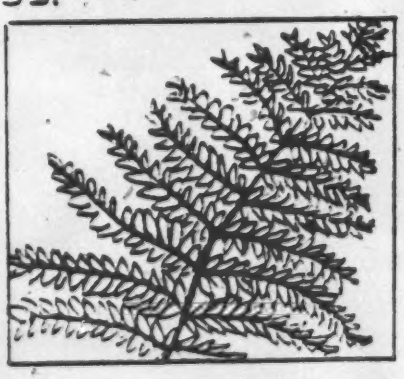
162.

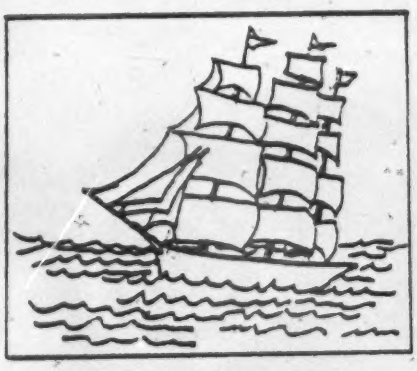


Page A12, Visual Analogy :

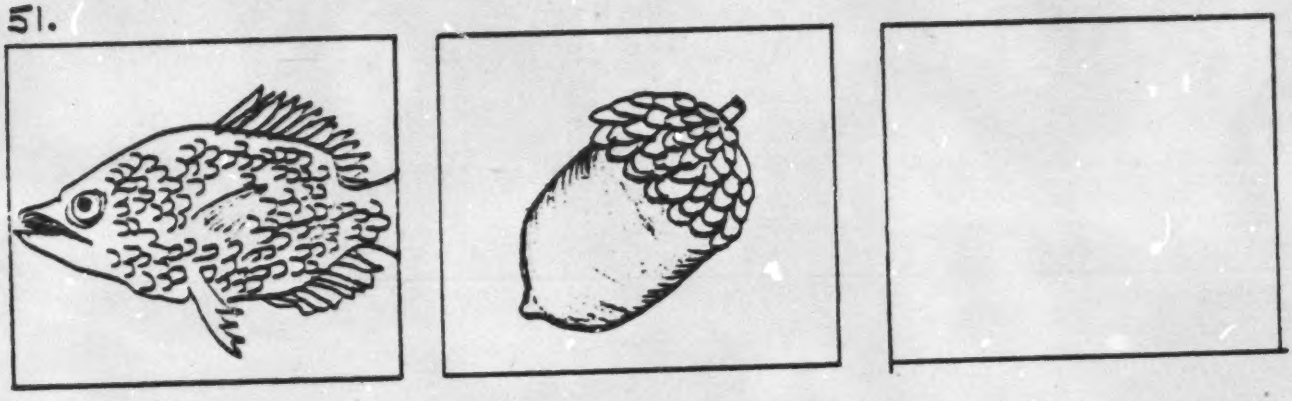
Make a drawing in the empty box that shows how the two pictures in each row look alike.

53.





51.



Page C50, Analogy:

Three of the four pictures look alike in some way. One picture does not look like the others. Make a big X through the picture that does not belong in the row.

217. Draw or write in the empty box how the other three pictures look alike.

Attleboro art teachers determined point values for each item in the test and designed templates with agreed upon tolerances to assist in the scoring of the tests. Based on these templates the scoring of both pre- and post-tests was completed by Attleboro and Community X art teachers during June, 1978. The values given to each of the five concepts tested are shown in Table I.

TABLE 1

Point Total for Concepts in Visual Arts Performance Test

Concept	Number of Test Items	Point Value
Sequence	6	7
Basic Structures	10	11
Depth	5	7
Balance	5	7
Visual Analogies	12	16

A comparison of the average Visual Arts Performance Test scores in Attleboro and Community X follows in Table 2.

TABLE 2
Visual Arts Performance Test Results

Community	N	$\bar{X}$ Pre-Test	$\bar{X}$ Post-Test	Average Gain	S.D.
Attleboro	80	20.57	32.05	11.48	5.27
Community X	16	21.81	27.31	5.50	3.27

On the total test and on each of the components of the test the Attleboro students showed significantly higher gains than did the students in Community X. It is interesting to note that the Attleboro students achieved a lower average pre-test score than the students in Community X on the total test and on all areas of the test except for Visual Analogies. The test results show that Attleboro 7th grade students have significantly improved their visual perceptual thinking skills as a consequence of school year visual arts educational ex-

periences. Analysis of total test scores indicate that the resulting gain is significant at the .01 level.

Table 3 indicates performance on each of the concepts tested in the Visual Arts Performance Test.

TABLE 3
Visual Arts Performance Test Results by Concepts

Concept	Community X $\bar{X}$ Pre-Test	Community X $\bar{X}$ Post-Test	Community X Average Gain	Attleboro $\bar{X}$ Pre-Test	Attleboro $\bar{X}$ Post-Test	Attleboro Average Gain
Sequence	5.44	6.00	0.56	4.61	6.02	1.41
Basic Structures	4.75	6.94	2.19	4.61	8.13	3.52
Depth	2.06	2.94	0.88	1.89	3.50	1.61
Balance	2.06	2.00	-0.06 (loss)	1.82	3.09	1.27
Visual Analogies	7.25	8.75	1.50	8.30	11.26	2.96

On the total test and on both the Sequence and Balance sections of the test, the Attleboro students showed an average gain at least twice as great as that achieved by the students in Community X. In the other areas of the test (Basic Structure, Depth and Visual Analogies) Attleboro students showed an average gain at least 1.5 times greater than the students in Community X.

Given the previously cited cognitivist theories of Broudy and Feldman, the significance of these results cannot be overstated when one considers the importance of visual arts in the basic education process. It is not possible to instruct children formally in basic subjects, such as reading and mathematics, until they are able to deal symbolically with fundamental concepts of those disciplines. Art is basic because it provides the symbolic imagery for dealing with

concepts. These images of art lead to conceptualization in word and number languages.

Table 4 gives some indication of how these visual arts concepts are related to basic education skills.

TABLE 4
Visual Arts Concepts and Basic Education Skills

Visual Arts Concept	Reading Skills	Mathematics Skills	Science Skills
Sequence	1.) Left to right progression 2.) Top to bottom progression 3.) Follow directions 4.) Recognize sequence of events in a written passage	1.) Counting 1a.) Number line 2.) Place value 3.) Use of abacus 4.) Order followed in basic mathematical addition, subtraction, multiplication, division 5.) Extrapolation	Progression of: 1.) Four seasons 2.) Life Cycle 3.) Tides 4.) Order of planets in the solar system
Basic Structures	1.) Recognition of letters and words 2.) Word meanings 3.) Parts of a book 4.) Use of simile and metaphor 5.) Identification of the main idea in a paragraph and story	1.) Forms used in math-such as circles, triangles, squares, rectangles, etc. 2.) Interpolation 3.) Process of addition, subtraction, multiplication, division	1.) Structure of matter a.) Atoms and molecules b.) Elements, compounds and mixtures 3.) Classification of species 4.) Crystalline structure
Balance	1.) Subject and predicate 2.) Agreement between noun and verb 3.) Main idea and supporting details 4.) Cause and effect	1.) Ratios, proportions 2.) Commutative and Associative properties 3.) Equations 4.) Reduction and expansion of fractions	1.) Conservation of matter and energy 2.) Ecology 3.) Balance in nature 4.) Chemical equation 5.) Water cycle

TABLE 4 (Continued)
Visual Arts Concepts and Basic Education Skills

Visual Arts Concept	Reading Skills	Mathematics Skills	Science Skills
Depth	1.) Imagination of spatial relationships from words read	1.) Projective drawing 2.) Solid and analytic geometry 3.) 3-D forms such as spheres and cylinders	1.) 3-D atomic and molecular models 2.) 3-D models of chemical bonding
Analogy	1.) Reading of graph, chart or map (analogue with referrent terrain) 2.) Understanding of metaphoric language	1.) Application of formulae to solution of word problems	1.) Formation of hypotheses 2.) Conceptualizatio through use of visua models

These are some of the ways by which a Visual Arts program contributes to the development of conceptualizing skills in basic education. It is because of these contributions that Attleboro has chosen to evaluate its Visual Arts program. This evaluation has shown that Attleboro students have made significant gains in basic conceptualizing skills. It has also raised some questions which are the subject of further study. These questions are:

1.) What was the reason that Community X students performed better on the pre-test than did Attleboro students?
2.) What would the results be if the same test were given to the same students at the end of 2, 3, and 4 years?
3.) How do these students from Attleboro and Community X compare on standardized test results in reading and math after having taken the Visual Arts Performance Test?
4.) Would the test results be affected if classroom teachers were trained to teach students to transfer visual conceptual skills to math and reading?
5.) Would the test results be affected if art teachers were trained to teach students to transfer visual conceptual skills to math and reading?

These questions are being studied and a sample of Attleboro students has been re-tested and has completed a questionnaire about their attitudes toward the Visual Arts. These test results and questionnaire responses are being analyzed at the present time.

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